

CLAIMS

We claim:

1. A system for collecting a plurality of samples of breath of a subject, comprising:
 - a breath conduit adapted to convey breath from the subject to said system;
 - a plurality of sample containers for collection of said plurality of samples;
 - a controller; and
 - a sample distributor which directs different predetermined samples of said breath to different ones of said plurality of sample containers according to said controller.
2. A system according to claim 1 wherein said controller causes said sample distributor to direct said samples at predetermined times.
3. A system according to claim 2 wherein said predetermined times are at fixed time intervals.
4. A system according to claim 2 wherein said predetermined times are determined by a characteristic of said breaths of the subject.
5. A system according to claim 4 wherein said characteristic of said breaths is at least one of the carbon dioxide concentration, the oxygen concentration, the excess pressure, the temperature, the humidity, the flow rate and the sound of said breaths.

6. A system according to claim 2 wherein said predetermined times are determined by at least one physiological characteristic of the subject.
7. A system according to claim 6 wherein said at least one physiological characteristic of the subject is selected from a group consisting of the subject's breath composition, breath rate, heart rate, blood pressure, gastric pH value and temperature.
8. A system according to claim 2 wherein said predetermined times are determined by an output from at least one of an implanted medical device, an ingested medical device, and an endoscopic medical device.
9. A system according to claim 8 wherein said implanted medical device is a drug delivery system.
10. A system according to claim 8 wherein said ingested medical device is an endoscopic capsule.
11. A system according to any of claims 1 to 10 and wherein said breath conduit comprises a nasal or oral/nasal cannula.
12. A system according to any of claims 1 to 10 and wherein said breath conduit comprises a breath tube.
13. A system for collecting a plurality of samples of breath from a subject, comprising:
 - a breath conduit adapted to convey breath from the subject to said system;
 - a breath analyzer for determining a characteristic of said breath;

a valving system to collect at least part of said breath, said valving system being actuated according to said characteristic of said breath;

a plurality of sample containers for collection of said plurality of samples; and

a sample distributor for directing different predetermined samples of said at least part of said breath to different ones of said plurality of sample containers.

14. A system according to claim 13 and wherein said sample distributor is operated manually.

15. A system according to claim 13 and also comprising a controller causing said sample distributor to direct said different predetermined samples to said different ones of said plurality of sample containers.

16. A system according to any of claims 13 and 15 wherein said breath analyzer is a capnographic analyzer, and said characteristic is the carbon dioxide concentration of said breath.

17. A system according to claim 16, and wherein said valving system is adapted to direct breath exhaled when said carbon dioxide concentration of said breath is at the plateau value of its waveform into said first of said sample containers, and breath inhaled when said carbon dioxide concentration of said breath is at the baseline of its waveform into said second of said sample containers.

18. A system according to claim 17, and wherein at least a first and a second of said sample containers contain a material which absorbs a predetermined gas of said breath of the subject, and at least said first and said second of said plurality of sample containers comprises a heater for expelling said predetermined gas of said breath of the subject.

19. A system according to claim 17, and also comprising a gas volume controller such that equal volumes of gas may be collected in said containers.
20. A system according to claim 19 and wherein said volume controller comprises a flow meter for measuring the volumes of breath directed into said sample containers.
21. A system according to claim 17, and wherein said volume controller comprises an intermediate chamber system.
22. A system according to any of claims 17 to 21 and wherein said predetermined gas is a volatile organic compound.
23. A system according to claim 16 wherein said part of said breath is determined by said carbon dioxide concentration of said breath.
24. A system according to claim 23 wherein said part of said breath is collected when said carbon dioxide concentration of said breath is at the plateau value of its waveform, such that alveolar air is sampled.
25. A system according to claim 23 wherein said part of said breath is collected when said carbon dioxide concentration of said breath is at the rising part of its waveform, such that dead space air is sampled.
26. A system according to claim 23 wherein said part of said breath is collected when said carbon dioxide concentration of said breath is at the baseline of its waveform, such that inhaled air is sampled.
27. A system according to any of claims 13 to 15 wherein said breath analyzer

is an oxygen content analyzer, and said characteristic is the oxygen concentration of said breath.

28. A system according to claim 15 wherein said controller causes said sample distributor to direct said samples at predetermined times.

29. A system according to claim 28 wherein said predetermined times are at fixed time intervals.

30. A system according to claim 28 wherein said predetermined times are determined by a characteristic of said breaths of the subject.

31. A system according to claim 28 wherein said characteristic of said breaths is at least one of the carbon dioxide concentration, the oxygen concentration, the excess pressure, the temperature, the humidity, the flow rate and the sound of said breaths.

32. A system according to claim 28 wherein said predetermined times are determined by a physiological characteristic of the subject.

33. A system according to claim 32 wherein said at least one physiological characteristic of the subject is selected from a group consisting of the subject's breath composition, breath rate, heart rate, blood pressure, gastric pH value and temperature.

34. A system according to claim 28 wherein said predetermined times are determined by a signal from at least one of an implanted medical device, an ingested medical device, and an endoscopic medical device.

35. A system according to claim 34 wherein said implanted medical device is a drug delivery system.

36. A system according to claim 34 wherein said ingested medical device is an endoscopic capsule.

37. A system for collecting a plurality of samples of breath from a subject, comprising:

a breath conduit adapted to convey breath from the subject to said system;

a valving system to collect at least part of said breath, said valving system being actuated according to a physiological characteristic of the subject;

a plurality of sample containers for collection of said plurality of samples; and

a sample distributor for directing different predetermined samples of said at least part of said breath to different ones of said plurality of sample containers.

38. A system according to claim 37 wherein said at least one physiological characteristic of the subject is selected from a group consisting of the subject's breath composition, breath rate, heart rate, blood pressure, gastric pH value and temperature.

39. A system according to any of claims 13 to 38 and wherein said breath conduit comprises a cannula.

40. A system according to any of claims 13 to 38 and wherein said breath conduit comprises a breath tube.

41. A system for collecting a plurality of samples of breath from a subject, comprising:

a breath tube through which the subject provides breath by blowing;

a pressure sensor for determining the pressure of said breath;

a valving system for collecting at least one sample from at least part of said breath, said valving system being actuated according to said pressure of said breath;

a plurality of sample containers for collection of said plurality of samples; and

a sample distributor for directing different predetermined samples of said at least part of said breath to different ones of said plurality of sample containers.

42. A system according to claim 41 and wherein said sample distributor is operated manually.

43. A system according to claim 41 and also comprising a controller causing said sample distributor to direct said different predetermined samples to said different ones of said plurality of sample containers.

44. A system according to claim 43 and wherein said controller prompts the subject at predetermined times to provide breath by blowing.

45. A system according to claim 44 wherein said predetermined times are at fixed time intervals.

46. A system according to claim 44 wherein said predetermined times are determined by a physiological characteristic of the subject.

47. A system according to claim 46 wherein said at least one physiological characteristic of the subject is selected from a group consisting of the subject's breath composition, breath rate, heart rate, blood pressure, gastric pH value and temperature.

48. A system according to claim 44 wherein said predetermined times are determined by an output from at least one of an implanted medical device, an ingested medical device, and an endoscopic medical device.

49. A system for collecting a plurality of samples of breath from a subject, comprising:

a breath tube through which the subject provides breath by blowing;

a plurality of sample containers for collection of said plurality of samples;

a one way check valve for directing said breath samples from said breath tube to said plurality of sample containers; and

a sample distributor for directing different predetermined samples of said breath to different ones of said plurality of sample containers.

50. A system according to claim 49 and wherein said sample distributor is operated manually.

51. A system according to claim 49 and also comprising a controller causing said sample distributor to direct said different predetermined samples to said different ones of said plurality of sample containers.

52. A system according to claim 49 and wherein said controller prompts the subject at predetermined times to provide breath by blowing.

53. A system according to claim 52 wherein said predetermined times are at

fixed time intervals.

54. A system according to claim 52 wherein said predetermined times are determined by a physiological characteristic of the subject.

55. A system according to claim 54 wherein said at least one physiological characteristic of the subject is selected from a group consisting of the subject's breath composition, breath rate, heart rate, blood pressure, gastric pH value and temperature.

56. A system according to claim 52 wherein said predetermined times are determined by an output from at least one of an implanted medical device, an ingested medical device, and an endoscopic medical device.

57. A system for determining the concentration compared to that of the ambient, of a volatile organic compound in the breath of a subject, comprising:

a breath conduit adapted to convey breath from the subject to said system;

a capnographic probe adapted to indicate the waveform of the breath of the subject;

at least a first and a second sample container;

a sample distributor directing different parts of said breath of said subject to different ones of said at least a first and a second sample container; and

a volatile organic compound analyzer; and

a gas transfer system adapted to pass said first and said second samples to said analyzer,

wherein said sample distributor is controlled by said capnographic probe such that said first container collects a first sample from the breath of said subject indicative of the ambient air inhaled by the subject; and said second container

collects a second sample from the breath of said subject indicative of the alveolar breath of the subject.

58. The system of claim 57 and wherein said first sample is collected at the baseline of the waveform of said breath of the subject, and said second sample of air is collected from the plateau volume of said breath of the subject.

59. A method of determining, in a breath test of a subject, the change in volume of a species in the subject's breath, comprising the steps of:

measuring a first concentration of said species in the breath of the subject by means of said breath test;

measuring a second concentration of said species in the breath of the subject by means of said breath test;

monitoring a physiological parameter of the subject related to the metabolic rate of the subject, for change in said parameter between the measuring of said first concentration and said second concentration; and

adjusting said second concentration according to change determined in said physiological parameter, such that said second concentration measured is representative of the volume of said species in the subject's breath.

60. The method of claim 59, wherein said physiological parameter of the subject is at least one of the pulse rate of the subject, the integrated area under a capnographic measurement of the subject's breath, and the breath flow rate of the subject.

61. A system according to any of the previous claims and wherein at least one of said sample containers contains a material which absorbs at least part of said breath of the subject.

62. A system according to claim 61 and wherein said material releases said at least part of said breath of the subject under the influence of heat.
63. A system according to any of the previous claims 1 to 60, and also comprising an evacuated chamber in which said plurality of sample containers are located.
64. A system according to claim 63 and wherein said sample containers are flexible bags.
65. A system according to any of the previous claims 1 to 60, and wherein said sample containers have rigid walls and are evacuated before the commencement of said collection of said samples.